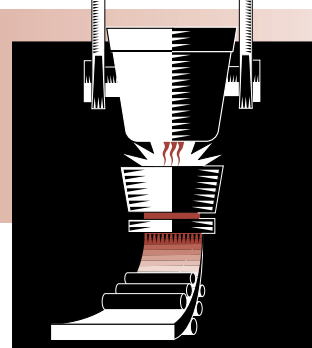


STEEL

Project Fact Sheet

THE MESABI NUGGET RESEARCH PROJECT NEW IRONMAKING TECHNOLOGY OF THE FUTURE: HIGH QUALITY IRON NUGGETS USING A ROTARY HEARTH FURNACE



BENEFITS

- 29% reduction in total energy per ton of steel at 70% scrap usage
- Capital requirements of the Itmk3® process are approximately half the cost of alternative technologies; lower operating costs anticipated due to less capital, equipment, labor, and energy
- Environmentally friendly process because Itmk3® does not require a coke oven or agglomeration plant, thus less NO_x, SO_x, and particulate matter are emitted

APPLICATIONS

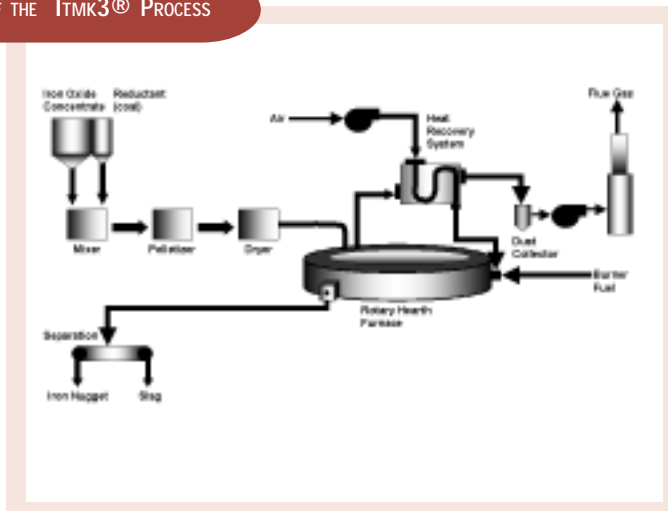
The is a simple one step rotary hearth furnace that produces iron at a lower cost than blast furnace pig iron. Quality of nuggets should be superior to direct reduced iron (DRI) and equal to blast furnace pig iron.

DEVELOPMENT OF A REVOLUTIONARY STEELMAKING PROCESS WITH A ONE-STEP FURNACE OPERATION THAT REQUIRES LESS ENERGY, CAPITAL, AND OPERATING COSTS

The Mesabi Nugget Project is a large-scale program currently underway to demonstrate the Itmk3® process developed by Kobe Steel, Ltd. The Itmk3® Process is a new ironmaking technology that uses a rotary hearth furnace to turn iron ore fines and pulverized coal into iron nuggets of similar quality as blast furnace pig iron. The Mesabi Nugget Research Project is a part of this larger program and is the subject of this award. A pilot demonstration plant is being assembled at a site in Silver Bay, MN. The Mesabi Nugget Research Project will consist of the operation of the pilot plant to demonstrate and optimize the new ironmaking technology to confirm the benefits of the process. Project partners will collect information on the process equipment and environmental data. A number of raw materials and process conditions will be tested. The iron nuggets produced will be evaluated in the commercial process of a steelmaker.

The Itmk3® process is a new ironmaking technology that uses a rotary hearth furnace to turn iron ore fines and pulverized coal into iron nuggets of similar quality as blast furnace pig iron. The new ironmaking technology will be able to effect reduction, melting, and slag removal in only about 10 minutes. The Itmk3® Process is an elegantly simple process with a one step furnace operation that requires less energy, capital, and operating costs than existing pig iron technology. Consequently, a high quality iron product at a substantially lower cost should be produced.

SCHEMATIC OF THE Itmk3® PROCESS



Itmk3® process flow sheet reveals a one-step furnace operation.



The Mesabi Research Project (Continued)

The chemical composition of iron nuggets is shown below.

Chemical Composition of Iron Nuggets	
C	2.5 – 4.3%
Si	0.2%
Mn	0.1%
P	0.06%
S	0.015 – 0.05%
Metallic Fe	Balance
Density	7.4 – 7.6g/cm ³

The iron nuggets can be fed directly to a basic oxygen furnace (BOF) or electric arc furnace (EAF) as a pure iron source instead of pig iron and as an excellent scrap substitute. The anticipated high quality and low cost iron nuggets are of great interest to EAF and BOF operators.

The recycling of scrap steel is an important issue for global environmental protection and the effective use of natural resources. The purity with respect to iron or the iron nugget product will facilitate a higher utilization of scrap recycling in EAF and BOF production due to its role of diluting tramp elements such as Cu, Pb, Sn, and Cr in order to produce flat products of high quality steel.

Another important aspect of the Itmk3® Process is that the process makes it possible for the mining industry to supply iron nuggets directly to melt shops from the mining site as a value added product by separating gangue elements from the iron ore. This means that mining companies can widen their market from the traditional pellet customer of a blast furnace to all melt shops at BOF, EAF, and foundry operations. This proposes an innovative concept on the rehabilitation of the mining industry and it has a potential to change the overall logistic systems in the steel industry.

The Itmk3® Process is unique in that nearly all the chemical energy of the ingredient fossil fuel is consumed and no gas credit is exported from the system. This is an important difference from the conventional blast furnace.

Itmk3® is environmentally superior because the process does not require a coke oven plant. Consequently, less NO_x, SO_x, and particulate matter (PM) are emitted than in the traditional BF system.

Project Description

Goal: To operate a 25,000 ton per year capacity Pilot Demonstration Plant aimed at developing a new ironmaking technology, the Itmk3® Process, to a state of commercial readiness.

The Mesabi Nugget Research Project will consist of the operation of the pilot plant to demonstrate and optimize the new ironmaking technology to confirm the benefits of the process. Project partners will collect information on the process equipment and environmental data. A number of raw materials and process conditions will be tested. The iron nuggets produced will be evaluated in the commercial process of a steelmaker.

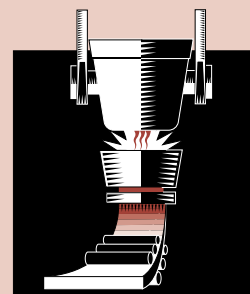
Progress and Milestones

A pilot demonstration plant is being assembled at a site in Silver Bay, MN. The Mesabi Nugget Research Project will consist of the operation of the pilot plant to demonstrate and optimize the new ironmaking technology to confirm the benefits of the process. This is a two-year project with the award recipient, Mesabi Nugget, LLC. The objectives of the Mesabi Nugget Research Project are:

1. Demonstrate the commercial readiness of the ITmk3® Process
2. Measure the environmental emissions and impacts of the iron nugget process and determine related control solutions.
3. Qualify and test the iron nugget product in a modern EAF steel making melt shop.
4. Assess a variety of raw materials and process conditions to determine optimal conditions for operation of the iron nugget process with respect to future commercial operations.

The Mesabi Nugget Research Project includes the operation of the Pilot Demo Plant (PDP), collection of environmental data and information on the process and equipment, technology development of the process to commercial readiness, iron nugget product testing at the strategic customer plant, and evaluation of a variety of raw materials and process conditions.

- Project Start Date: October 1, 2002
- Project End Date: September 30, 2004



PROJECT PARTNERS

Mesabi Nugget, LLC
Silver Bay, MN
(Principal Investigator)

Ferrous Resources, LLC
Butler, IN

IronUnits LLC
Cleveland, OH

Midrex Technologies, Incorporated
Charlotte, NC

North Shore Mining Company
Silver Bay, MN

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Simon Friedrich
Office of Industrial Technologies
Phone: (202) 586-6759
Fax: (202) 586-9234
simon.friedrich@ee.doe.gov
<http://www.oit.doe.gov/steel>

Please send any comments,
questions, or suggestions to
webmaster.oit@ee.doe.gov.

Visit our home page at
www.oit.doe.gov.

Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585



April 2003